Applying Stress Tests to Build A Risk Appetite Framework

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Agenda

✓ The Importance of Stress Tests on Risk Management

➢ The Influence of Regulators on Stress Tests

➢ A Risk Appetite Framework Based on Stress Tests

➢ The Difficulties of Stress Tests in Practice

➢ Conclusion
The Importance of Stress Tests on Risk Management

- **Known**: refers to a situation where the probability distribution is completely specified, and the underlying model is well understood.

- **Unknown**: refers to a situation where the probability cannot be assigned to at least some events, and there are competing models, none of which has ascended to the status of a paradigm.

- **Unknownable**: refers to a situation where even the events cannot be identified in advance—neither events nor probabilities are known, and there is no underlying model or no model with scientific credibility.

The Definition of Stress Tests:

The BIS Committee on the Global Financial System (BCGFS) (2000) defines “stress testing” as- “a generic term describing various techniques used by financial firms to gauge their potential vulnerability to exceptional, extreme or simple unexpected but plausible events”

The Position of Stress Tests:

Stress tests not only can be used in the assessment of capital adequacy, but also can be used as a risk management approach to understand a bank’s risk profile and ability to withstand extraordinary effects that generate from internal or external distress.
The Importance of Stress Tests on Risk Management

- **Foundation for Risk Appetite Management**

  Apply stress tests & scenario simulation as the foundation to set up risk tolerance limits and form risk appetite framework.

- **Basis of Early Warning System**

  Regularly implement stress tests to detect any deterioration or warning signals in business operations.
The Importance of Stress Tests on Risk Management

- **Assessment for Business Strategy Adjustment**
  
  Analyze stress testing results to discover any potential risk of business exposure and adopt necessary measures to adjust business strategies.

- **Enhancement of Capital Management**
  
  Use stress tests to strengthen capital management plans and make periodical checks to make sure the sufficiency of capital to prevent systematic risk.
Agenda

- The Importance of Stress Tests on Risk Management
- The influence of Regulators on Stress Tests
- A Risk Appetite Framework Based on Stress Tests
- The Difficulties of Stress Tests in Practice
- Conclusion
The Result of Fed’s Stress Tests 2015

The Fed’s stress tests first implemented in 2009 and made annual in 2011. In the result of stress tests 2015, all 31 banks tested stayed above the minimum levels of capital buffers, but the U.S. units of two foreign-based banks which were Spain’s Banco Santander and Germany’s Deutsche Bank received objections from Fed. However, Goldman Sachs Group Inc, Morgan Stanley and JPMorgan Chase & Co, all with large and risky trading operation, each had to adjust their dividends and share buybacks plan to meet the Fed’s minimum capital requirements. Bank of America have to resubmit its capital plan to Fed due to weaknesses in its modeling practices and internal controls.
The Result of ECB’s Stress Tests 2014

ECB published the stress testing result of financial Institutions in Eurodollar Zone in October 2014, which showed there were 25 banks did not pass the stress tests. The most shortage of the total capital is within the banking industry in Italy. The insufficiency reached 25 billion Euro Dollars. Under this situation, the overall financial condition of Italy banking industry could be concerned if there are any market crisis happened.
Since 2008 financial tsunami, Taiwanese supervisory authorities have requested the banking industry to adopt stress tests in their risk management process.

In order to solve the problem of Insufficient data in each individual bank, Taiwanese supervisory authorities coordinated the banks and JCIC to form a common data platform.

- Periodical meetings for banks and JCIC to discuss stress testing scenarios and possible solutions.
- Instruct JCIC to provide external data and DBR-estimation

Provide principles of supervisory review on sound stress testing for banks to follow

- The Rules of Stress Testing Operations for Banks (by FSCEY)
The influence of Regulators on Stress Tests

- Provide important common scenarios to banks for stress testing exercises.

- Combine with Pillar II requirement, examine and evaluate banks’ liquidity and capital adequacy; Request banks to take proper measures to respond the stress-testing results.

- Request the board of banks to take the final responsibility on stress tests, and senior managements to be responsible for the implementation, management and supervision of the stress testing practice.

- Inspect banks’ implementation of stress tests and take into consideration of each bank’s size, business focus, operation complexity to help the bank to adopt a sound and proper stress testing policy and practice.
# The Comparison of Stress Tests in Europe, USA & Taiwan

<table>
<thead>
<tr>
<th>Country</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contingency Variable</strong></td>
<td><strong>Domestic Variable</strong></td>
</tr>
<tr>
<td></td>
<td>- Economic Activity: Real and Nominal GDP, Unemployment Rate, Nominal disposable Income, CPI</td>
</tr>
<tr>
<td></td>
<td>- Real estate and financial market: Home Price Index, US real estate index, Dow Jones Industrial Average index, VIX</td>
</tr>
<tr>
<td></td>
<td>- Interest rate: 3M T-BILL rate, 10 years government bond yields, 10 years BBB corporate bond yields, 30 years mortgages rate</td>
</tr>
<tr>
<td></td>
<td><strong>International Variable</strong></td>
</tr>
<tr>
<td></td>
<td>- Four economic groups: Eurodollar Zone, United Kingdom, Japan, Developing Country in Asia (China, India, Hong Kong, Taiwan)</td>
</tr>
<tr>
<td></td>
<td>- 3 variables: Real GDP, CPI, the foreign exchange rate to USD</td>
</tr>
<tr>
<td><strong>Operational risk</strong></td>
<td>Fraud, System errors, etc.</td>
</tr>
<tr>
<td><strong>Characteristic</strong></td>
<td>- Consider the risks from domestic and international economic variables at the same time</td>
</tr>
<tr>
<td></td>
<td>- Contain the operational risk factors</td>
</tr>
</tbody>
</table>
# The Comparison of Stress Tests in Europe, USA & Taiwan

<table>
<thead>
<tr>
<th>Country</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contingency Variable</td>
<td>Macroeconomic in EU</td>
</tr>
</tbody>
</table>
| | ➢ Economic growth in each country  
| | ➢ Unemployment Rate  
| | ➢ CPI  
| | ➢ Harmonized Index of Consumer Prices in Eurodollar Zone  
| | ➢ 10 years governments bond yields in each country  
| | ➢ 3 months interest rate in each country  
| | ➢ Stock Index in each country  
| | ➢ The level of house price  
| | ➢ The price of commercial real estate  
| | ➢ The foreign exchange rate of EUR/USD. |

<table>
<thead>
<tr>
<th>Characteristic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>➢ More countries to receive stress tests, therefore, there are less variable being used. Scenarios used are also more gentle.</td>
</tr>
<tr>
<td></td>
<td>➢ Without considering the default of sovereignty debt, only consider the change of government bond price.</td>
</tr>
</tbody>
</table>
### The Comparison of Stress Tests in Europe, USA & Taiwan

<table>
<thead>
<tr>
<th>Contingency Variable</th>
<th>Macroeconomic situation</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GDP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unemployment Rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The level of house price</td>
</tr>
<tr>
<td>The elements of other risk linkages</td>
<td>The decline rate of collateral price from construction industry</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The decline rate of other business revenue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The decline rate of housing price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The decline rate of real income.</td>
</tr>
</tbody>
</table>

#### Characteristic
- The elements of loan linkage index are more precisely.
- The stress tests are more focusing on Credit Risk.
- The stress tests are more focusing on individual exposure.
Agenda

- The Importance of Stress Tests on Risk Management
- The influence of Regulators on Stress Tests
- A Risk Appetite Framework Based on Stress Tests
  - The Difficulties of Stress Tests in Practice
  - Conclusion
The definition of risk appetite

“Risk Appetite” is a financial institution’s predetermined or selective attitude toward risks. The Senior Supervisors Group’s “Risk Management Lessons from the Global Banking Crisis of 2008” report suggested that financial institutions needed to make demonstrable improvement in “articulating a clearly defined risk appetite” to guide strategic decisions and remediated the risk management weakness of resisting financial crisis.

The main ideas of building a risk appetite framework

- Financial crisis revealed that many financial institutions do not properly understand, monitor and communicate their risk.

- Global banks, regulators and rating agencies are increasingly focusing on risk appetite.
Stakeholders desire continuous development and increased formalization of risk management.

Boards require continuing communications to have meaningful discussion and challenge.

The need to improve the explicit linkage of risk appetite to strategy, capital planning, risk limits and business decisions.

Banks should not rely just on a single measure or purely quantitative measures.

Banks need to continue on stress tests, scenario analysis, as well as improving the use of quantitative measures for non-financial risks.
Risk Appetite Framework

Using Stress Testing Frameworks for quantifying major risks and further management

**Risk Governance**
- Risk appetite setting and control
- Organization structure and roles for risk management
- Risk reporting

**Capital Adequacy**
- Calculating regulatory capital requirement for various risks
- Planning and executing to fulfill capital requirements

**Stress Tests**

**Stress Scenarios**
- Evaluating and measuring expected and unexpected losses
- Categorizing and quantifying all major risks via stress tests
- Defining a common standard for various risks for comparison

**Simulation & Quantification on Risk**
Stress Testing Workflow

130 scenarios

Financial Risks
   Operating Risks
   50 scenarios

Strategy Risks

Framework for Risk Categorization

20 scenarios

Filtering & Quantification

Common Standard Framework of Risk Management

Final Objective
   5-7 groups of scenarios

Review on Quantification
   (Comparing with BU’s Risk Models)

Quantification & Application for Risk Appetite

Risk Quantification and Framework Setting
Tier 1
Strategic Investment Risks

Tier 2
Ongoing Strategic Focus

Tier 3
General Operation / Less Strategically Concerned

Tier 4
Strategically Immaterial Risks

Threshold
(Amount of Loss)

Risk Reporting Line Setting

Reporting line:  

tolerance line:  

Risk Tolerance Line Setting

Risk Appetite Segmentation & Monitoring
## Risk Appetite Segmentation Definition

<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
<th>Risk Reporting Line</th>
<th>Risk Tolerance line</th>
</tr>
</thead>
</table>
| Tier 1 | Strategic Investment Risks  
           (e.g. M&A) | Board discussing & monitoring | Board discussing & monitoring |
| Tier 2 | Ongoing strategic focus  
           (e.g. SME Lending, Credit Card) | u% of Net Worth | x% of Net Worth |
| Tier 3 | General Operation / Less Strategic Concerned  
           (e.g. Market Risk, ALM) | v% of Net Worth | y% of Net Worth |
| Tier 4 | Strategically Immaterial Risks  
           (e.g. Rogue Trader) | w% of Net Worth | z% of Net Worth |
Timing and Process of Stress Testing Review

- Periodically Review of Risk Scenarios & Risk Appetite
- Change of Internal/External Environment
- Stress Testing Framework
- Risk Appetite Framework
- Generate New Scenarios
- Change of Risk Appetite

Capital Planning
Tier 2 Capital

Capital Buffer

Extra-capital add-in based on internal capital adequacy

Min. Capital requirement under Pillar I

Review of Risk Appetite
- Compare risk tolerance with the expectation of rating agencies and regulators
- Review the capital consumption of various risks
- Scrutinize the setting of risk tolerance, and combine it with risk appetite

Combination with Capital Planning
- Adjust capital requirement on the basis of business cycles
- Develop feasible capital planning
Principles and Methodology of Stress Testing

Based on Basel II Requirement

Comply with Authority’s Rules and Suggestions

External Consultant

Internal Experts

NPL Mgt. Div.
Audit Div.
Business Units
Risk Mgt. Div.
Other Divisions

Practical Focus in E. SUN’s Stress Testing Methodologies
e.g. Different Testing Methods for UPL and Mortgage
## Preparations for Stress Testing Execution

<table>
<thead>
<tr>
<th>Improvement on Model Development</th>
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<tbody>
<tr>
<td>➢ PD、LGD、EAD</td>
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</table>

<table>
<thead>
<tr>
<th>Scientific Approach &amp; Practical Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Statistic Method</td>
</tr>
<tr>
<td>➢ Expert Experience</td>
</tr>
<tr>
<td>➢ Business practicability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emphasis of Risk Management Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Top-Down Approach</td>
</tr>
<tr>
<td>➢ Internal Policy</td>
</tr>
<tr>
<td>➢ Senior Management</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Compliance Impact Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Banking Law</td>
</tr>
<tr>
<td>➢ Personal Information</td>
</tr>
<tr>
<td>Protection Act</td>
</tr>
<tr>
<td>✓ More Difficult to Collect</td>
</tr>
<tr>
<td>Updated Data from Customers.</td>
</tr>
<tr>
<td>(e.g. DBR)</td>
</tr>
</tbody>
</table>
Methodology of Stress Testing

< Case on Mortgage >

- **Select Scenario**
  - Earthquake in Taipei Area
  - Burst of Mortgages Bubble
  - Rapid Rise of Interest Rate

- **Estimating EL**
  - PD (Long-Run, Stress)
    - DBR alternation
  - LGD (IRB Approach)
    - CLTV

- **Action Plan**
  - Loan Position Adjustment
  - Capital-Raising Plan
  - Control of Total Amount

- **Reporting Result**
  - Impact on Capital & Profit
    - RMC
    - Board of Directors
    - Audit Committee
**Risk Response Process**

**When Exceeding the Risk Appetite…**

- Reduce Asset Size
- Increase Capital

**Strategic Response**

- Evaluate the cost & benefit of each response from a combination consideration
- Strict control on higher risk exposures.
- Set limits on the total amount of business exposures.
- Reduce the importance level of specific business, and adopt a more conservative development approach.
- Adopt risk mitigation measures.

**Responses**

- Capital Perspective
  - Reduce Asset Size
  - Increase Capital

**Capital Perspective**

- Value Perspective
For the early warning point of view, banks can use risk appetite limits to review their capital adequacy to make sure there is enough capital buffer to meet the regulatory capital requirement under extremely situations.

The scenario of stress test in the extremely occasion

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Risk Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Credit Risk</td>
</tr>
<tr>
<td>B</td>
<td>Credit Risk</td>
</tr>
<tr>
<td>C</td>
<td>Credit Risk</td>
</tr>
<tr>
<td>D</td>
<td>Credit Risk</td>
</tr>
<tr>
<td>E</td>
<td>Credit Risk</td>
</tr>
<tr>
<td>F</td>
<td>Market Risk</td>
</tr>
<tr>
<td>G</td>
<td>Market Risk</td>
</tr>
<tr>
<td>H</td>
<td>Market Risk</td>
</tr>
<tr>
<td>I</td>
<td>Operational Risk</td>
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<tr>
<td>J</td>
<td>Operational Risk</td>
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<tr>
<td>K</td>
<td>Operational Risk</td>
</tr>
<tr>
<td>L</td>
<td>Operational Risk</td>
</tr>
<tr>
<td>M</td>
<td>Other Risk</td>
</tr>
<tr>
<td>N</td>
<td>Other Risk</td>
</tr>
</tbody>
</table>

![Graph showing BIS ratio before and after stress test for 2014 Q2 and Q3](chart.png)
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✓ The Difficulties of Stress Tests in Practice
➢ Conclusion
The Difficulties of Stress Tests in practice 1/2

- **Internal environment:**
  - High difficulties of implementing integrated stress tests.
  - If stress tests have to contain the perspective and impact of economy, it would take more time to negotiate with different divisions when setting the stress testing parameters.
  - Most financial institutions right now only use the stress testing results as the auxiliaries to enhance risk management. It still need a lot of tasks for them to really apply stress testing outcomes in capital planning.

- **External environment:**
  - The increasing awareness of personal information protection.
  - The constraints of regulations from supervisors.
The Difficulties of Stress Tests in practice 2/2

- Only proceed specific risks or single asset class portfolio stress tests, lack an integrated stress tests mechanism.
- Assume historic events are good scenarios to predict future situations, underestimate the possibility and impact of extremely events.
- Underestimate the correlation of each stress scenario.
- Fail to integrate the result of stress tests into risk management framework and decision.
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Stress tests are not just the matters of sciences, but also the matters of arts. Risk management culture and governance both play important roles.

To design a proper and sound stress testing and risk appetite policy and scheme, a bank should consider its size, business focus, and the complexity of its operation. Big banks or operation complicated banks should improve their risk management technique to keep up with their business developments, and consider the changing of forward-looking risk factors and their correlations to present the entire risk pictures under distress period.
Conclusion

- When implementing stress tests, a bank should consider different opinions from all divisions, and prudently review those opinions from different angles and techniques, using reasonable quantitative and qualitative techniques to support and make up for the deficiencies of models.

- The drive of big data and new technologies have made stress tests more reasonable and precise, therefore, the development of stress tests and risk appetite framework will continue playing an important role for financial institutions to improve their risk management functions, and also will be an important risk management indicator for regulators to monitor.
Creating a culture of risk awareness®

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